

FIG. 1

100

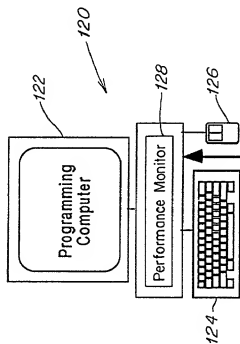
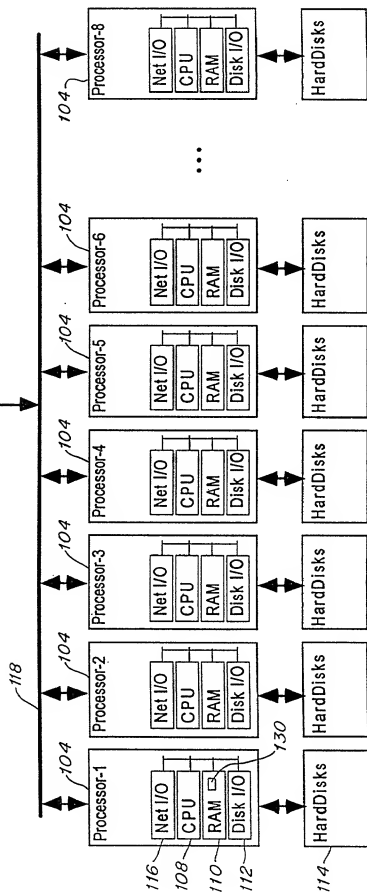


FIG. 2



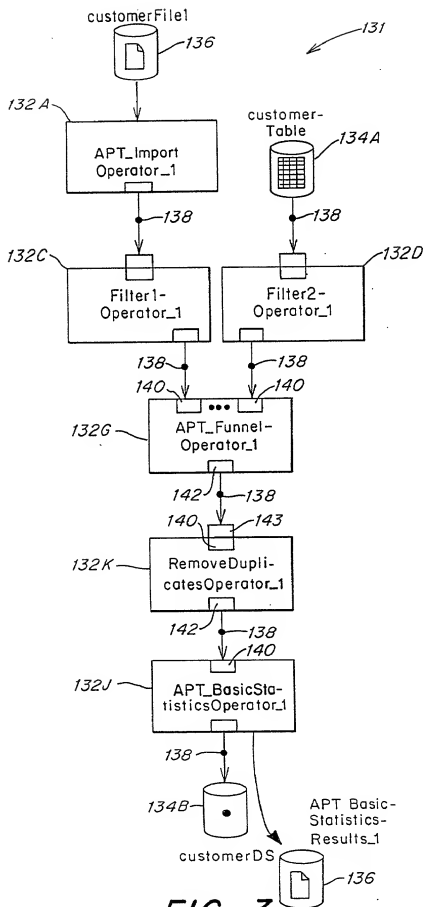


FIG. 3

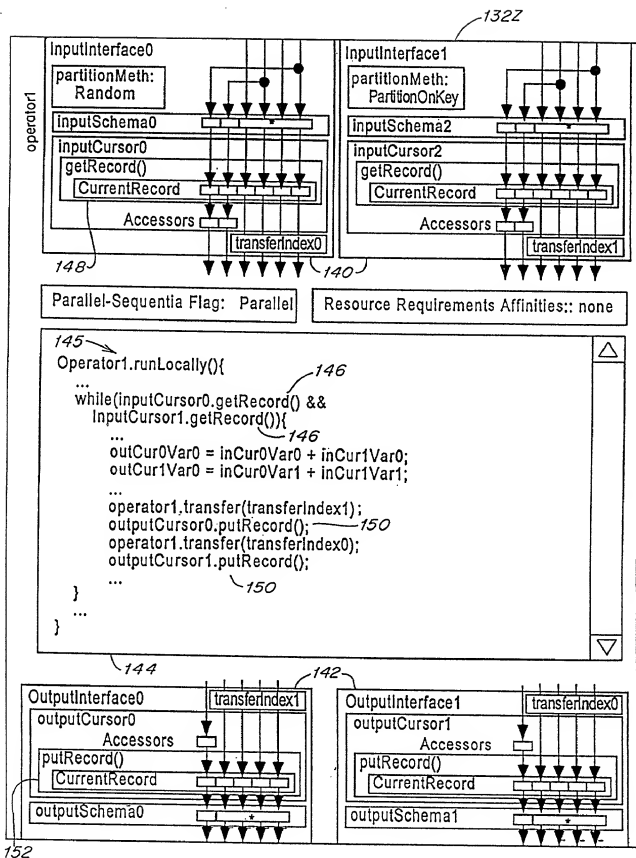


FIG. 4

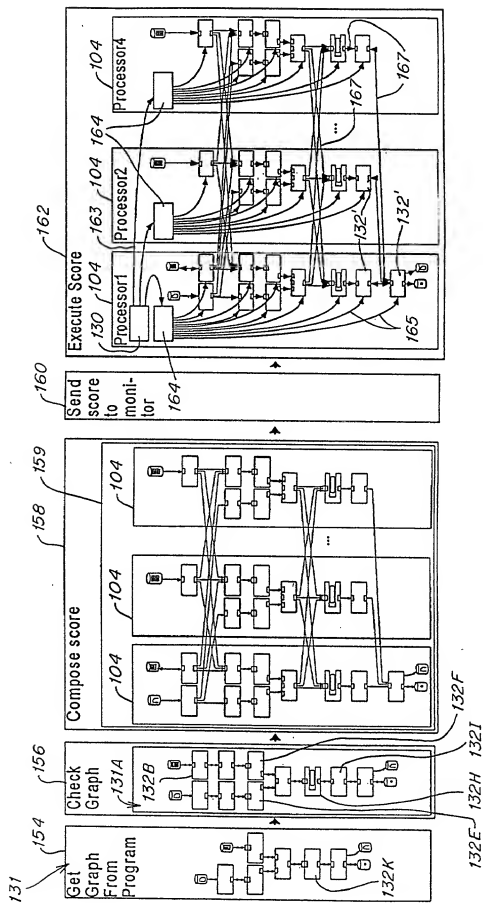


FIG. 5

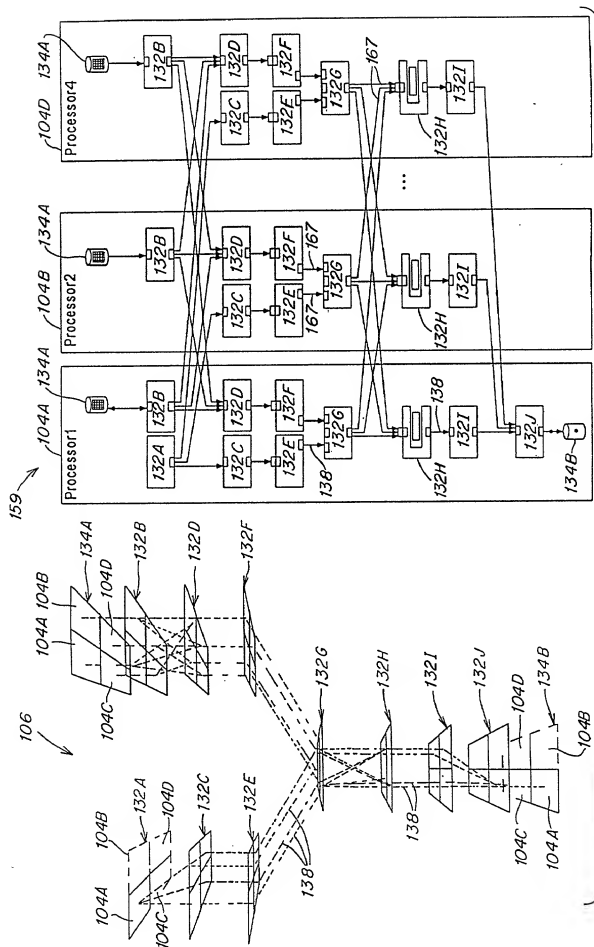


FIG. 6

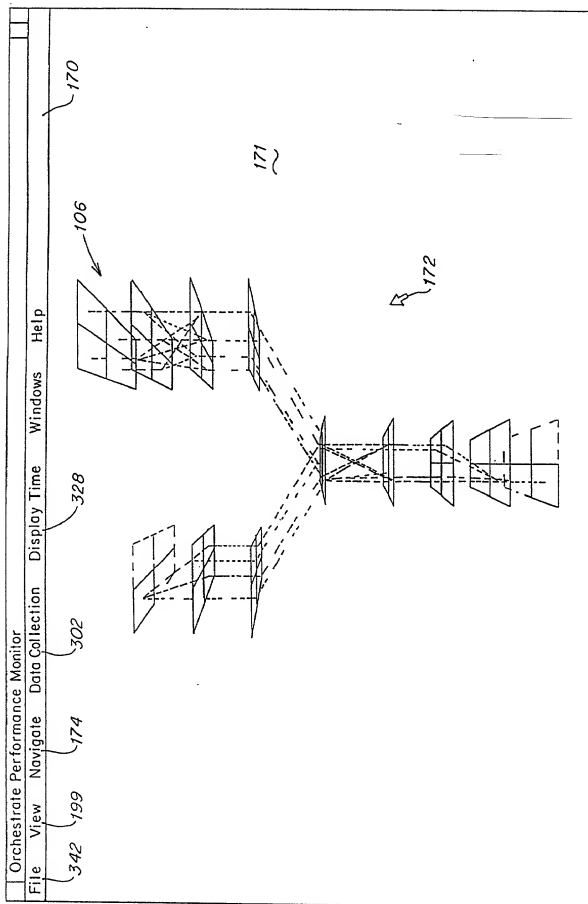


FIG. 7

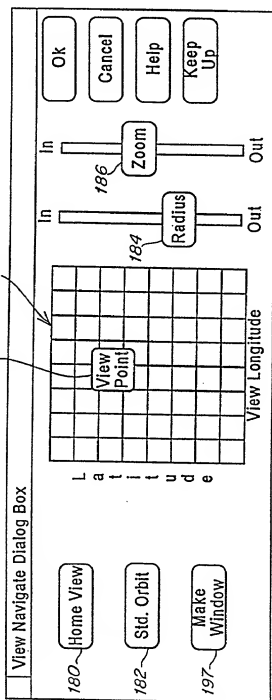


FIG. 8

- View Menu~198
 - 2D Views~200
 - By Instances~216
 - By Operators~218
 - ...
 - 3D Views~202
 - Expansion Level~220
 - By Instances~228
 - By Operators~230
 - By Levels~232
 - By Processors~234
 - By System~236
 - ...
 - Display Ports~203
 - Datalink Display~204
 - Labels~205
 - No Labels~254
 - Name Only~ 255
 - Block Diagram~272
 - Bar Graphs~207
 - Number Processors~206
 - Get & Put Hangs~210
 - EOF Display~211
 - Monitored field~212
 - Saved Visualization Manager~213

FIG. 9

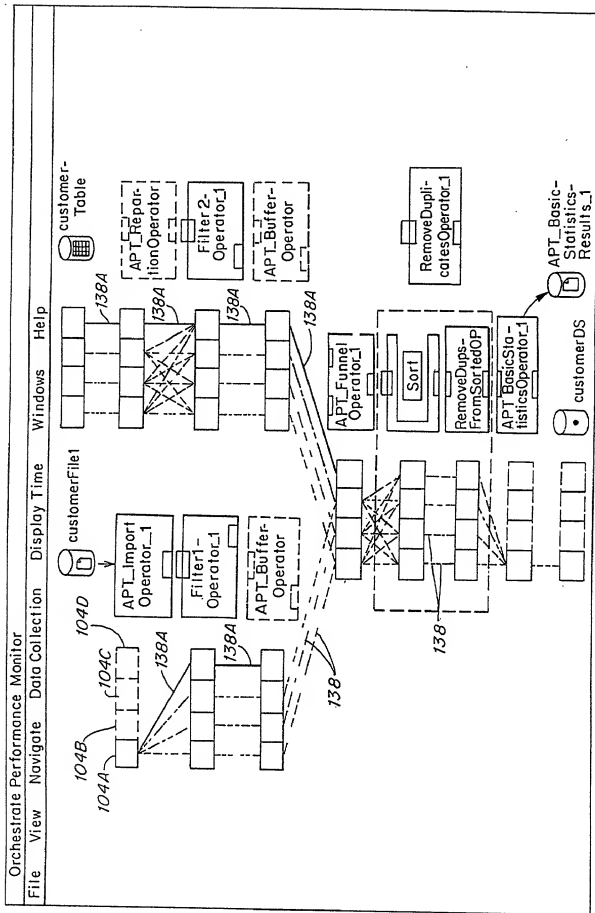


FIG. 10

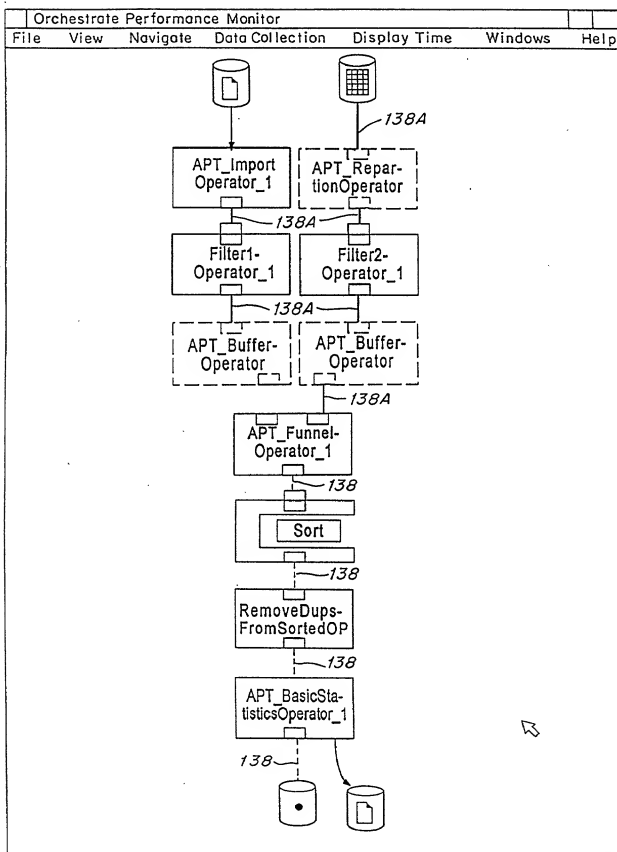


FIG. 11

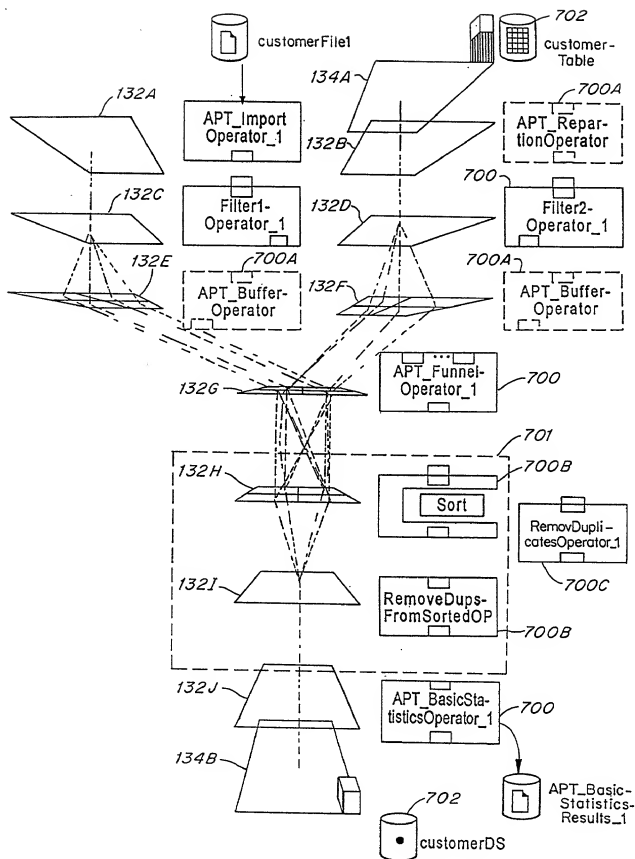


FIG. 12

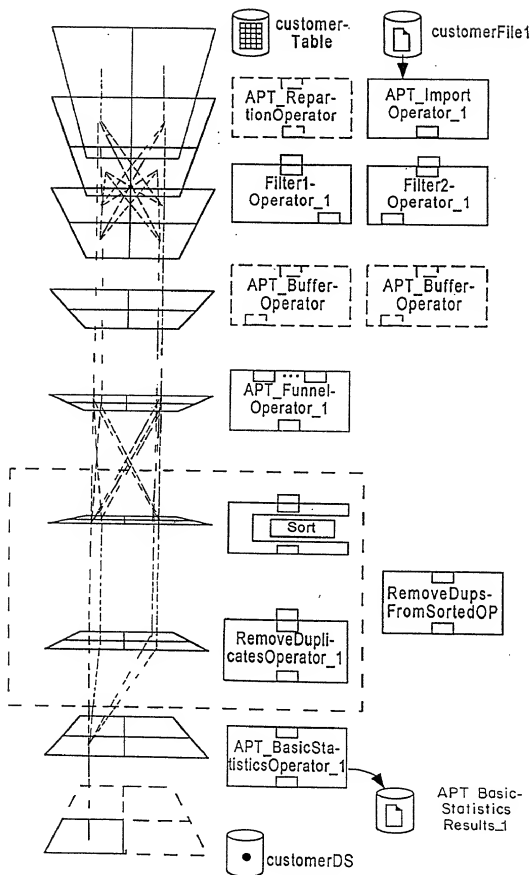


FIG. 13

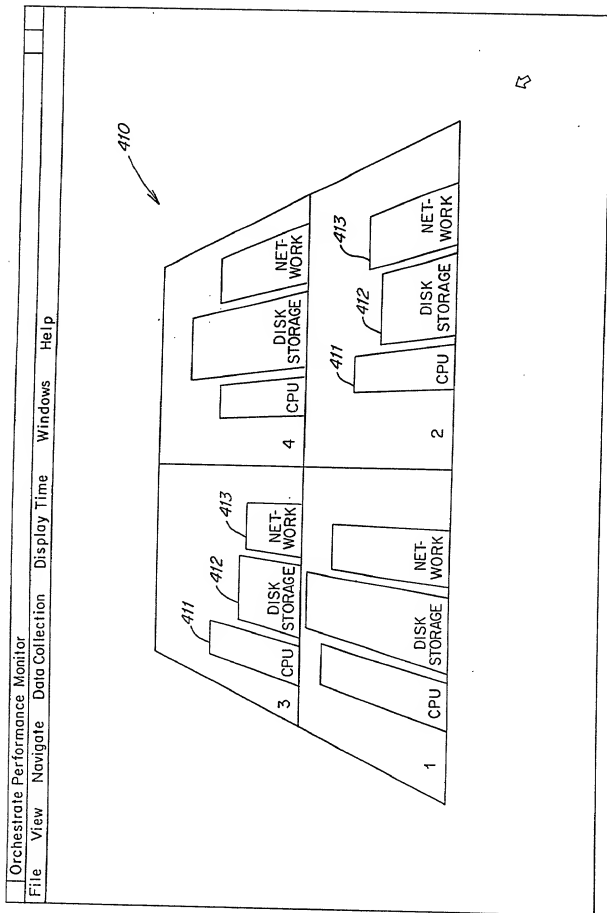


FIG. 14

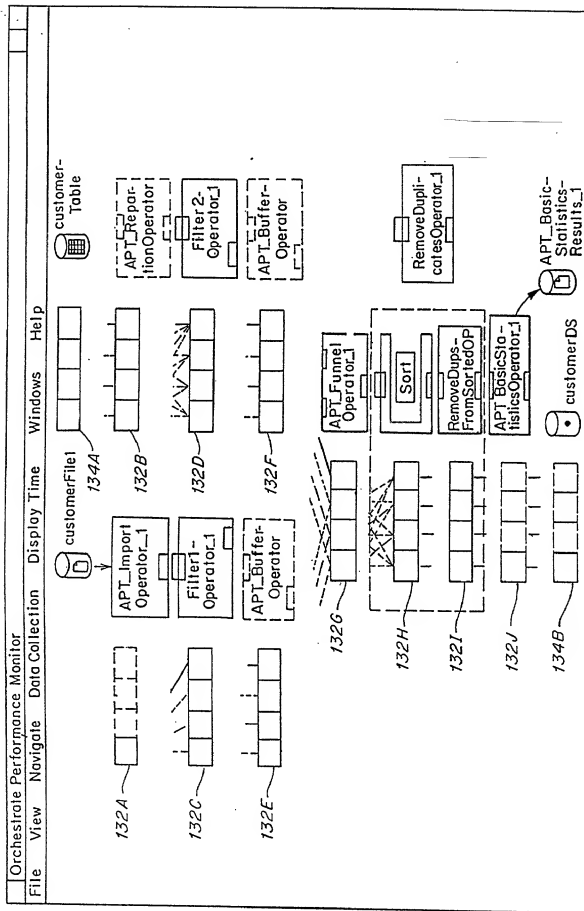


FIG. 15

- barGraphDisplayDialogBox3~238
 - bar graphs on
 - [] persistent data set~240
 - [] buffer operator~241
 - [] operator~242
 - graph
 - show~243
 - flow rate in () bytes, or () record ~244
 - [] outputs and/or [] inputs
 - total flow to date in () bytes, or () records~245
 - [] outputs and/or [] inputs
 - [] relative to total records in input data set~245A
 - disk I/O rate in () bytes or () records~246
 - () plain, () % of maximum, or () compared to remaining
 - network I/O rate in () bytes or () records~248
 - () plain, () % of maximum, or () compared to remaining
 - [] disk storage as in bytes ~250
 - () plain, () % of maximum, or () compared to remaining
 - [] CPU usage as % of maximum~251
 - () plain, () % of maximum, or () compared to remaining
 - direction~252
 - () perpendicular to node array
 - () on surface of each node
 - [] label scale on graphs~258
 - ok
 - cancel
 - help

FIG. 16

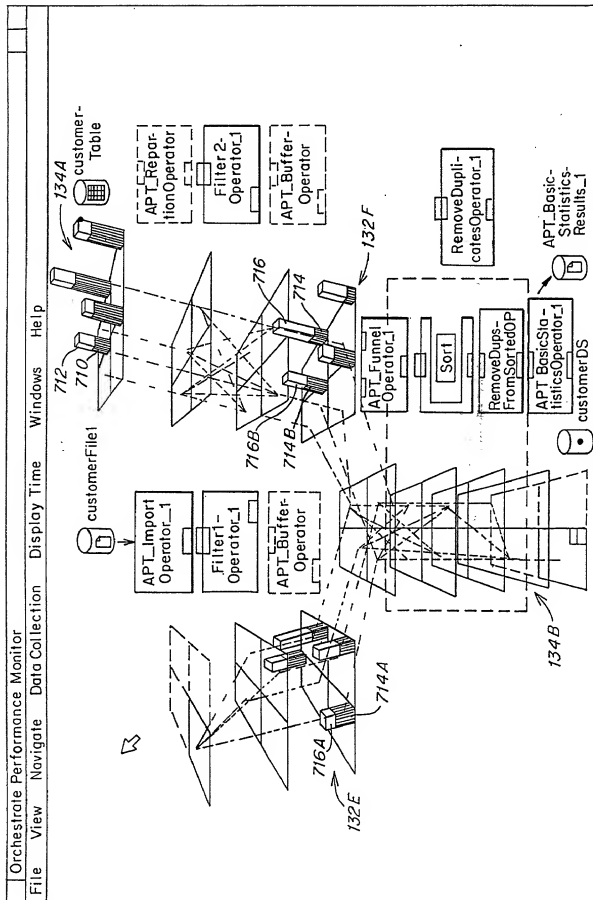


FIG. 17

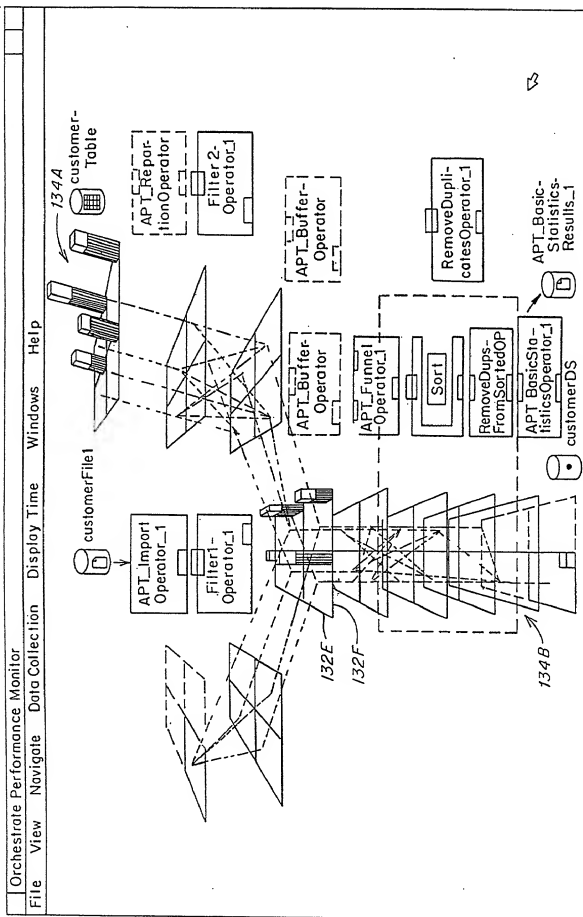


FIG. 18

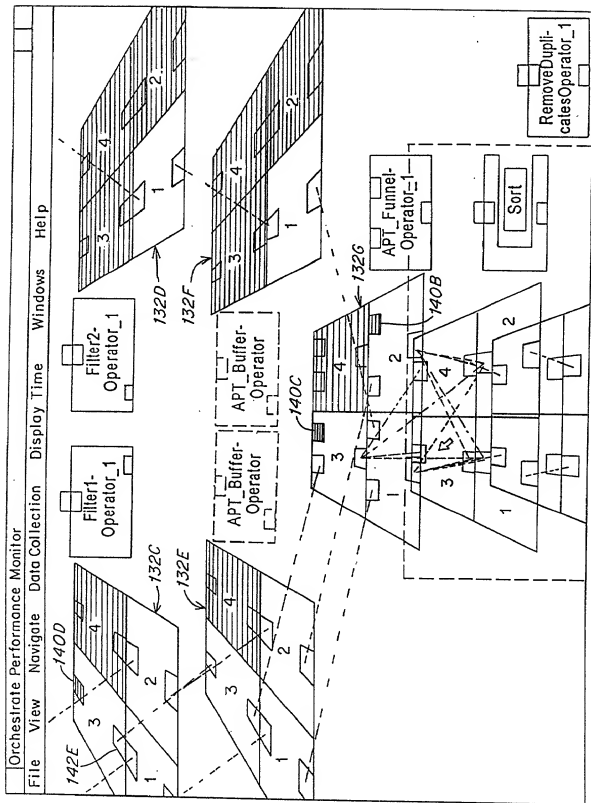


FIG. 19

- datalinkDisplayDialogBox~260
 - [] display datalinks~261
 - color data link by~263
 - source () node or () operator~264A
 - destination () node or () operator~264B
 - flow rate in () records or () bytes~264C
 - inverse flow rate in () records or () bytes~264D
 - total records sent in () records or () bytes~264E
 - inverse of total records sent in () records or () bytes~264F
 - () partition method~264G
 - monitored field value
 - by () 1st letter, () 1st number, or () color map~264H
 - monitored field settings (button) ~265
- segmentation
 - () solid~266A
 - data rate rain by
 - () records/sec or () bytes/sec~266B
 - () color history ~266C
 - () show entire time of graph execution along datalink~267A
 - () show [editbox] secs along datalink~267B
 - separately color every [editbox] secs~267C
 - [] show time scale along datalinks (checkbox)~267D
- color map dialog (button)~268
- flow rate time frame~269
 - () avg in last second
 - () avg in last minute
 - () avg in last [edit box] sec
- ok
- cancel
- help

FIG. 20

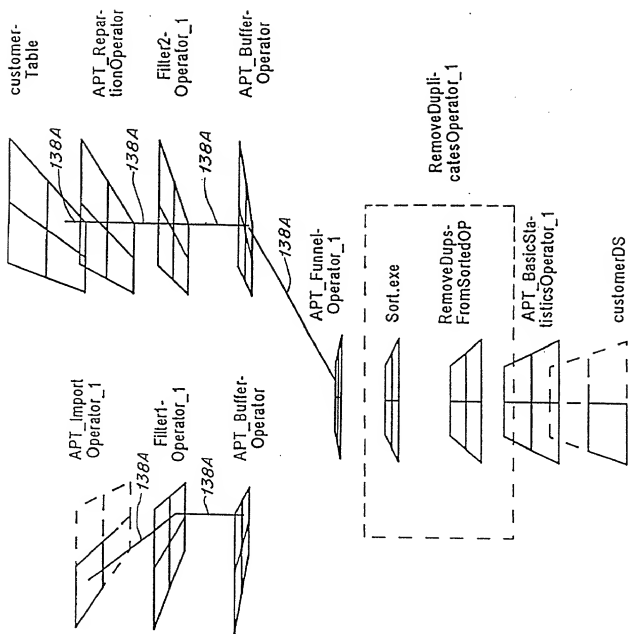


FIG. 21

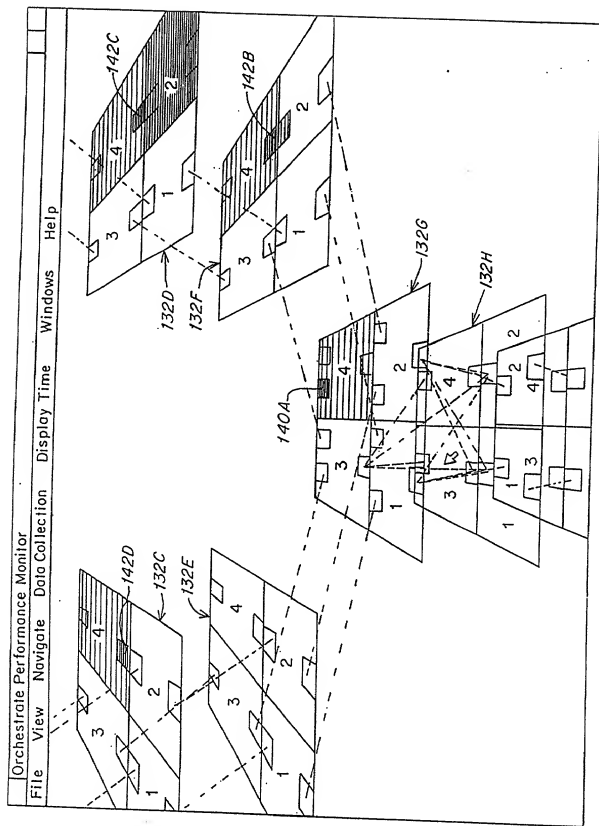


FIG. 22

374

Monitored Field Dialog Box

☒ Field Monitoring On 375

Field Name 376

Monitoring Frequency 378

380 Every 381 Secs

382 Every blockSent Msg

Outputs by

☒ Field Display Window 384

☐ With Find Arrows 385

Trace by Desired Values 392

1st Desired Value 394

Match

398 Initial Letters

400 All Letters

402 Msg First Occurrence

Show in Datalinks With

404 Balls 406 Triangles

2nd Desired Value 396

Match

398 Initial Letters

400 All Letters

402 Msg First Occurrence

Show in Datalinks With

404 Balls 406 Triangles

Ok

Cancel

Help

FIG. 24

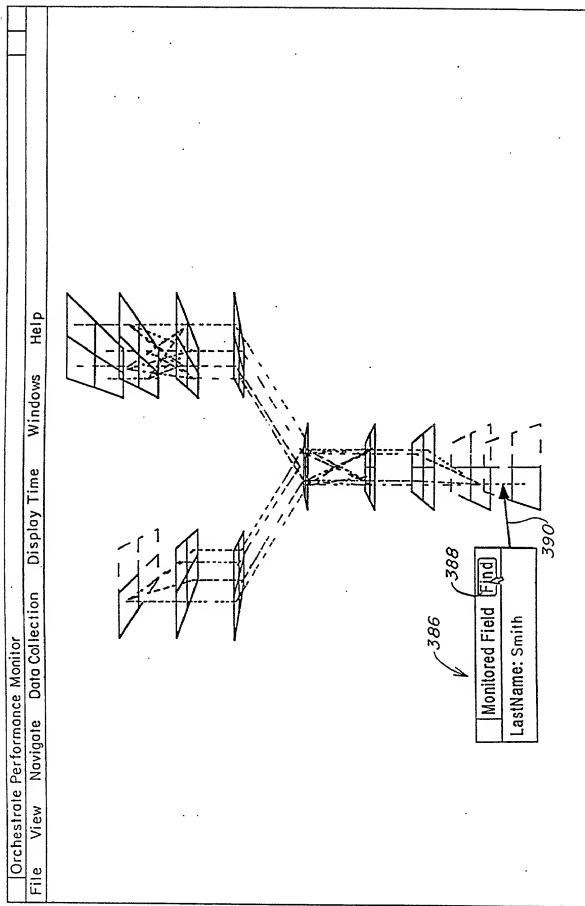


FIG. 25

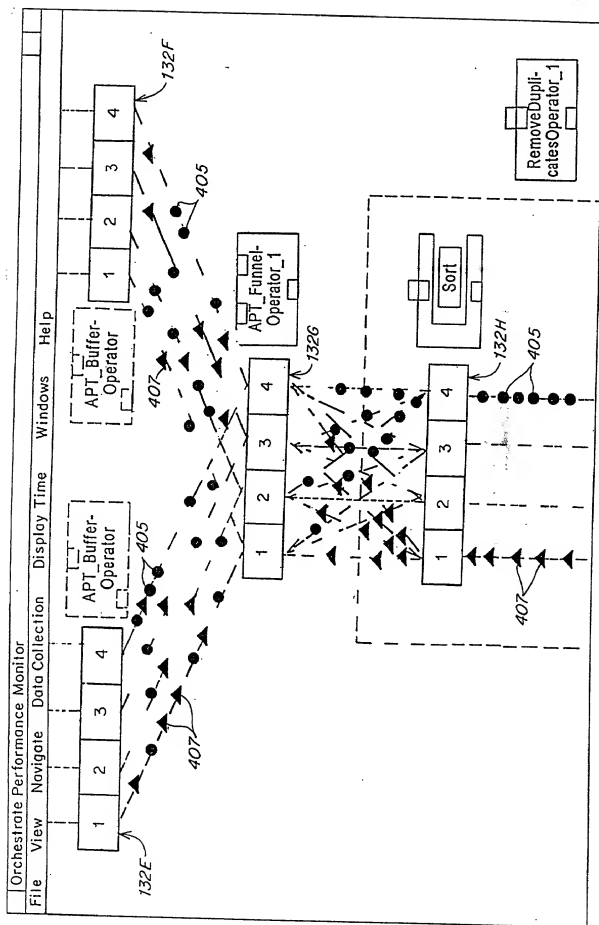


FIG. 26

- getAndPutHangsDialogBox~266
 - [] monitor get and put hangs~271
 - consider call hung after [editbox] secs~270
 - highlight~272
 - [] port with hung call~274
 - [] hung operator instances~276
 - [] hung datalinks~278
 - [] don't highlight hangs for ports which have not handled any records~279
 - color hung getRecords as solid [color button grid]~280
 - color hung putRecords as solid [color button grid]~282
 - [] display time of hang~284
 - ok
 - cancel
 - help

FIG. 23

- EOFDisplayDialogBox~290
 - display EOFs by
 - [] port~292
 - [] operator~294
 - [] datalink~296
 - highlight EOFed objects as solid [color button grid]~298
 - [] display time of EOF~300
 - ok
 - cancel
 - help

FIG. 27

- DataCollection Menu~304
 - record performance~306
 - not at all~312
 - every second~314
 - every minute~316
 - custom~318
 - monitor performance~308
 - not at all~320
 - every second~322
 - every minute~324
 - custom~326
 - ...

FIG. 28

- DisplayTime Menu~330
 - realtime~332
 - replay~334

FIG. 29

- replayDialogBox~336
- time slider~338
- replay speed slider~340
- ...
- ok
- cancel
- help

FIG. 30

- operator objectMenu~343
- make focus and nav~354
- collapse instances~356
- collapse operators at level~355
- object overview~358
- performance overview~360
- datalink display~362
- bar graph~368
- monitored fields~370
- ...

FIG. 31

- operator port objectMenu~344
- make focus and nav~354
- collapse instances~356
- object overview~358
- performance overview~360
- datalink display~362
- bar graph~368
- monitored fields~370
- monitor records~372
- ...

FIG. 32

- operator instance objectMenu~346
- make focus and nav~354
- collapse instances~356
- debug~357
- object overview~358
- performance overview~360
- datalink display~362
- bar graph~368
- monitored fields~370
- ...

FIG. 33

- operator port instance objectMenu~348
 - make focus and nav~354
 - collapse instances~356
 - debug~357
 - object overview~358
 - performance overview~360
 - datalink display~362
 - bar graph~368
 - monitored fields~370
 - monitor records~372
 - ...

FIG. 34

- datalink objectMenu~350
 - make focus and nav~354
 - collapse instances~356
 - object overview~358
 - performance overview~360
 - datalink display~362
 - monitored fields~370
 - monitor records~372
 - ...

FIG. 35

- datalink instance objectMenu~352
 - make focus and nav~354
 - collapse instances~356
 - debug~357
 - object overview~358
 - performance overview~360
 - datalink display~362
 - monitored fields~370
 - monitor records~372
 - ...

FIG. 36

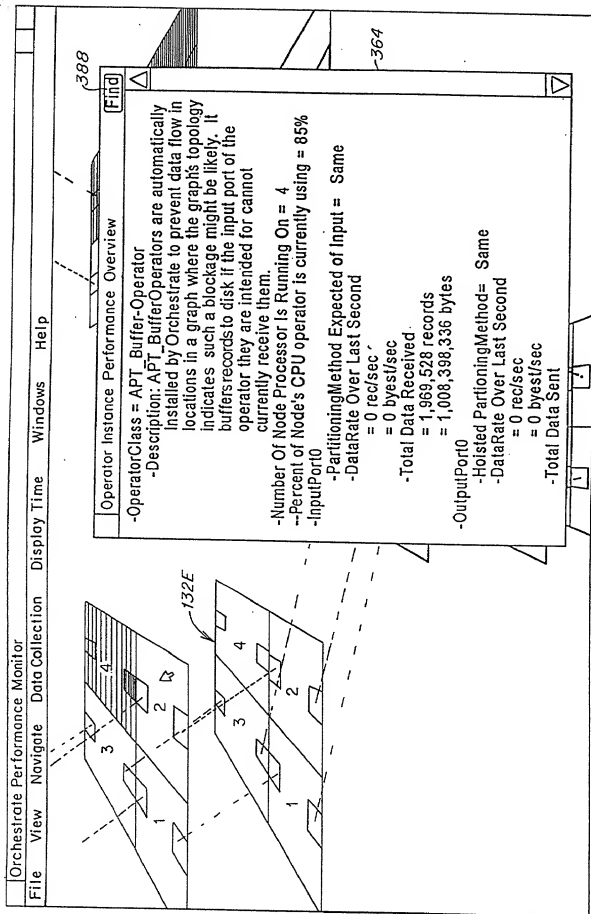


FIG. 37

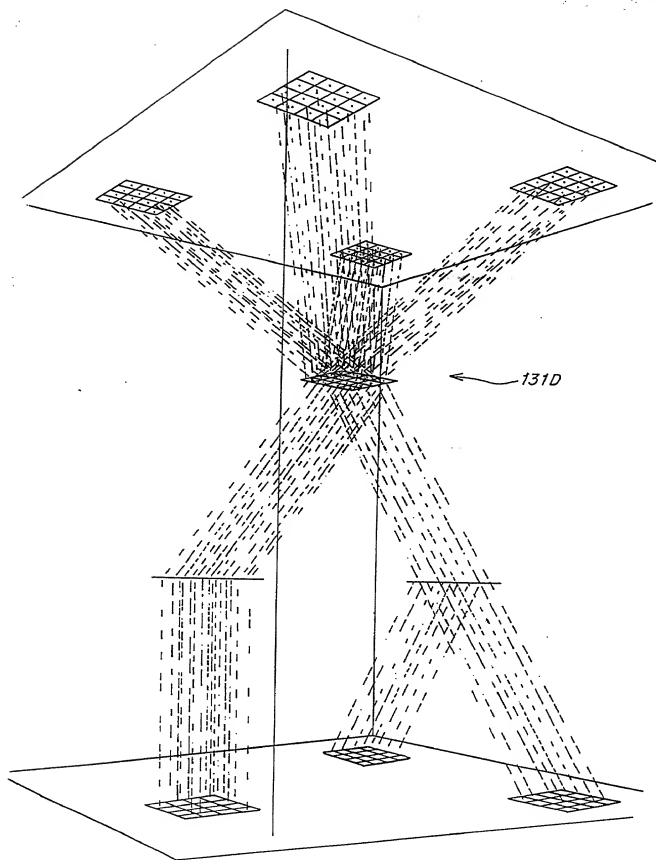


FIG. 38

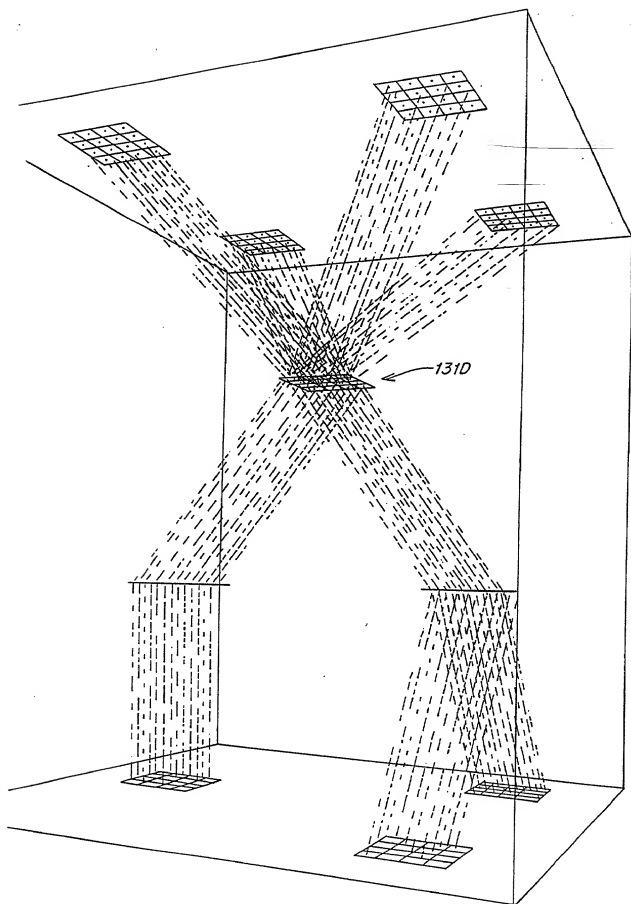


FIG. 39

-putRecord~152

-place record in buffer block addressed to one of one or more instances of the output port's consuming input port based on the partitioning scheme~420

-if record fills buffer block~422

-if getAndPutMonitoringIsOn, send the performance monitor timed putBlockPending UDP msg, identifying the sourceNode, sourceProcessOnNode, and sourceOutputOnProcess~424

-if output port's datalink is connected to a data set, write block to that data set~425

-else send buffer block to its corresponding consuming input port instance over TCP/IP~426

-call buildAndSendBlockSentMsg~423

-return~462

FIG. 40

-buildAndSendBlockSentMsg~429

-if current block contains EOF or if time since the last blockSent message was sent for current datalink exceeds desired blockSent interval~427

-assemble standard blockSent UDP msg including appropriate values for the messages sourceNode, sourceProcessOnNode, sourceOutputOnProcess, destinationNode, destinationProcessOnNode, destinationInputOnProcess, numberOfRecordsSoFar, numberOfBytesSoFar, timeSent, and isEOFInRecord~428

-If fieldMonitoringIsOn~430

-for each entry in monitoredFieldTable having matching source and destination~432

-if time since lastTimeRecordSent is greater than desiredSendInterval, place monitorFieldHeader in blockSent, followed by numberOfDesiredValue1, numberOfDesiredValue2, and the extracted field value from last record in current block~434

-If recordMonitoringIsOn~450

-if entry in monitoredRecordTable has matching source and destination~452

-if time since lastTimeRecordSent is greater than desiredSendInterval~454

-place monitorRecordHeader as the last record in blockSent~456

-send performance monitor the blockSent UDP message~460

return~461

FIG. 41

- performanceMonitor~128
- initialize~480
 - receive score description from process composing score of, and conducting the parallel execution of, the data flow graph~482
 - create data structures for all nodes, operators, operator instances and their ports, and datalink instances~484
 - determine which operators are in which levels~486
 - lay out operators in each level in both 2 and 3-d space~490
 - loop until user exits from within~492
 - while unprocessed user input, call handleUserMsgs~494
 - while msgs in UDP input queue, call handleUDPMsgs~496
 - for each graphState portrayed in a replay window, call UpdateReplayGraphState~532
 - if time since timeOfLastBlockPendingCheck exceeds blockPendingCheckInterval, call blockPendingCheck~550
 - for each graph visualization window~554
 - if it has been longer than windowUpdateInterval since it was last updated~569
 - if window is a 3Dview~570
 - if a flight path is active for window, and if time since last move along flight path exceeds flight path's flightPathFrameInterval, change view parameters according to flight path~572
 - if its viewRadiusFromFocus, viewLongitudeFromFocus, viewLatitudeFromFocus, or viewZoom has been changed, call updateWindows3Dto2DProjection~574
 - call updateWindowsPixels~576
 - if the window is a 2D view update it~621

```

-handleUDPMsgs~498
-for each message in the queue~500
-if getBlockPending msg, store it in data structure for its associated input port
instance~502
-else if putBlockPending msg, store in data structure for its associated output
port Instance~504
-else if blockSent msg ~506
-if historyRecordingIsOn~508,
-if time since last blockSent was recorded for the msg's data link
instance exceeds blockSentRecordInterval, store a copy of
blockSent msg in the blockSentHistory file in chronological order
by time stamp~510
-if blockSent's isEOFInRecord is true, record blockSent in
EOFHistory file~511
-call updateGraphWithBlockSentMsg with the blockSent msg for
realTime graphState ~512

-return~530

```

FIG. 44

```

-updateGraphStateWithBlockSentMsg~531
-erase any getBlockPending, putBlockPending, hungOnGetRecord, hungOnPutRecord in
data structures for all inputs or outputs on same instance having an earlier time stamp
than the blockSent msg~513
-if there is a prior blockSent msg recorded for the data link, calculate dataRates for the
current blockSent msg's corresponding datalink instance by subtracting
numberOfRecordsSoFar and numberOfBytesSoFar from the prior blockSent stored in
data structure of the datalink instance having msg's associated source and destination
ports from numberOfRecordsSoFar and number of BytesSoFar, respectively, in the
current msg and divide difference by the difference in timeSent of the two msgs~514
-store the dataRate in the datalink instance's data structure~515
-store the current value of blockSent in the datalink instance's data structure~516
-if blockSent's isEOFInRecord is true, set hasSentEOF in blockSent's corresponding
datalink instance~517
-if there is a monitoredFieldHeader in the current blockSent~522
    -if there is a window opened to display monitored field information for the
    datalink instance, feed the monitored field information to that window~524
    -if msgFirstOccurrence has been set for either the 1stDesiredValue or
    2ndDesiredValue, check if the blockSent msg contains the first occurrence of
    either desired value and if so beep and send appropriate window to display~526
-if blockSent contains a monitoredRecordHeader and if there is a window opened to
display that record for the datalink instance, feed blockSent's monitored record
information to that window's process~528
-return~529

```

FIG. 45

```

-getRecord~148
-if there is no record in input port's input buffer~464
-if getAndPutMonitoringIsOn, send performance monitor timed getBlockPending
UDP msg, identifying the node, processOnNode, and inputOnProcess~465
-if input port's datalink is connected to a data set~466
    read next block from that data set~467
    call buildAndSendBlockSentMsg ~468
    -else wait until input buffer gets a new block of records~469
    -set inputBlockReadPointer to start of new block~470
    -set return value to value of InputBlockReadPointer~474
    -Increment inputBlockReadPointer by length of record~476
    -return~478

```

FIG. 42

```

-updateReplayGraphState~534
-if the time since lastGraphStateUpdateTime exceeds replayUpdateInterval~535
    -save the current time as lastRealTimeOfGraphStateUpdate~536
    -find next timeBeingReplayed ~537
    -scan EOFHistory file and get&PutHangHistory files since the graphState's
    previous timeBeingReplayed, to update EOF and getRecord and putRecord
    hang values of port and operator instances~538
    -clear the blockSent msg and dataRate stored for all datalinks in the
    graphState~539
    -for each item in the blockSentHistory file recorded from timeBeingReplayed back to
    timeBeingReplayed - replayUpdateWindowDuration~540
        -if a blockSent msg corresponding datalink for which a dataRate
        has not been calculated in the GraphState call
            updateGraphStateWithBlockSentMsg~542
    -return~543

```

FIG. 46

```

-updateWindowsPixels~588
  -for all datalink objects in the window which have to be updated and which might contain
  any transparent segments, erase all pels associated with it~589
  -for each object in the visualization window's graphState mapped into the window's 2D
  projection which has been changed since the last call to this routine~590
    -if it is a datalink object~592
      -if datalink object's colorSetting is "off", skip rest of loop~594
      -else if datalink object's colorSetting is a function of a selected
      variable~596
        -if object is a composite, set its value for the selected variable to
        the average of the values of that variable from all its
        corresponding instances~598
        -select object's draw color from the position of its value for the
        selected variable relative to the variable's color map~600
      -else if datalink object's colorSetting is a fixed color set its draw color
      equal to that color~602
      -else if datalink object's segmentationSetting is for a color histogram,
      call colorHistogramSegmentation~604
      -else if datalink object's segmentationSetting is for dataRate noodles, call
      noodleSegmentation~606
      -if datalink object's segmentationSetting is Solid, set lineSegmentBuffer
      to one solid segment~608
      -call drawLineSegments~610
    -if it is not a datalink object, project it into the view's pel map, taking into account
    what objects block what other objects from perspective of viewpoint~614
  ...
  -return~616

```

FIG. 49

-blockPendingCheck~552
 -for the data structure of each port instance~556
 -if it has a getBlockPending or putBlockPending indication with a time stamp
 older than normalBlockPendingTime~558
 -label the data structure for port as hungOnGetRecord or
 hungOnPutRecord, respectively~560
 -if recording is on, record hungOnGetRecord or hungOnPutRecord,
 respectively, and its associated time for port instance in
 get&PutHangHistory file~562
 -Return~564

FIG. 47

-updateWindows3DTo2DProjection~578
 -set viewDirectionLongitude and viewDirectionLatitude to keep view centered on
 viewFocus~582
 -call calculateGraphs2DProjectionCoordinates~584
 -return~586

FIG. 48

-colorHistogramSegmentation~618
 -if time or time scale represented by window has changed, update outputPortPointer and
 inputPortPointer in the lineSegmentBuffer accordingly~620
 -if any part of the object's lineSegmentBuffer between its outputPortPointer and
 inputPortPointer is not segmented, calculate histogram color segmentation for that
 portion of the buffer from either real time values, or if appropriate, relevant portions of
 blockSentHistory file~622
 -return~624

FIG. 50

```

-noodleSegmentation~626
-advance outputPortPointer and inputPortPointers in lineSegmentBuffer in proportion to
current dataRate~628
-for each part of the object's lineSegmentBuffer between its OutputPortPointer and
inputPortPointer which is empty, starting at the outputPortPointer~629
-until such empty portion has been filled~630
    -add a new pair of "on" and "off" segments to the buffer, having a density
    which is a partially random function of link's dataRate for the time frame
    represented by that segment's location along the line representing the
    datalink object~631
    -if monitoredFieldDisplaysOn, if the datalink object has a monitored
    field, and if a blockSent message is detected in the time represented by
    such pair has a value for that field represented by either a triangle or a
    ball, replace the pair's "on" segment in the buffer with a triangle or
    ball~634

-return~635

```

FIG. 51

```

--drawLineSegments~636
  -Erase all pixels, if any, previously associated with the current datalink object by
  step 648 in a previous call to the routine~637
  -for each line segment in the current datalink object's lineSegmentationBuffer which
  maps into the window~638
    -if it's color is "off" skip rest of loop~642
    -for each successive portion of that line segment which has been projected onto
    an individual pel of the the view~643
      -if pel was not formerly colored~644
        -if the segment's color is "on", color the pel with the datalink
        object's draw color~645
        -else color the pel with the segment's color~646
        -store the ID of the current datalink object in association with the
        pel~648
      -else, if the current datalink object is between the view point and the
      object previously associated with the pel at the point on each object
      represented by the pel, store the color of the current datalink object at
      the pel and associate the current datalink object with the pel~650
    -return~652

```

FIG. 52